and Ultratec.

Additional requirements have been set:

- Provide status report quarterly
- Consumer notification - requires an action team with large support group from consumer groups and with careful focus and agreement on content of notification message.

Effort for consensus on wording for Notification Message to be used by The Customer Awareness Team in producing their contribution.
Essential points:

- Background on TTY and technology issues.
- Reference to timeframe of information to ensure up-to-date information is shared
- Focus on TTY access. Groups could adapt message to accommodate special needs. Providers will work with groups to ensure accurate information.
- Analog section is controversial since some carriers cannot provide the analog fallback.
- What is commercially available solution for digital today - not what is technically possible.
- RJ-11 interface has not been proven. Acoustic coupling was proven for all phones at last TTY Forum.
- Identify whether dual mode phones can be locked into analog mode for duration of TTY calls.
- PCS is digital and has achieved adequate delivery of messages over TTY.
- CDMA/TDMA not proven.
- Need to provide generic message applicable to all technologies represented today.
- Message needs to be as clear to lay population as possible. Break message into technology and effect on TTY.
- Be careful to use universal terms so that deaf person can go to store and ask for "one of these" and have clerk understand terms.

WEIAD STATUS REPORT TO FCC

The WEIAD Status Report was delivered to the FCC on January 29, 1998. Anyone interested in a copy of the report can call Ed Hall at CTIA.

WORKING GROUP #1/3

Summary:
A contribution of text to use as an objective test of TTY over the air interface was presented. Test was accepted as modified by the addition of scenario-based text. Requirement was identified to develop a second, subjective, test. A working group, chaired by Toni Dunne, was formed to prepare a contribution of a subjective test to be presented at the next TTY Forum. Discussion centered on defining acceptable error rate, proper testing, and satisfying the FCC

requirements. Contribution WEIAD/98.02.11.06 and Contribution WEIAD/98.02.11.07 were presented to amplify the discussions of error rate measurement, lab testing, and potential solutions.

Wesley Howe, GTE Wireless, co-chair presented the Working Group #1/3 report. Established performance criteria with subset of a text message and established acceptable error rate. Group will provide consensus opinion to acceptability of testing and error rate.

Used 72 characters per line to eliminate carriage return as a variable. Specify inter-character delay pre-determined. Error rate is calculated on characters. Over 2500 characters included in test. Is the shift character characteristic of Baudot included in the test? No. The character sets are randomly set to include a lot of character transitions. The shift character rate is significant because the shift key error will cause the next character to be erroneously transmitted.
Comments:

- Noted that the recommended process at TTY Forum-2 was an actual example of an interactive 9-1-1 call script.
- Concern: ASCII output to the modem is not Baudot. We cannot simulate shifting here. Recommend using Baudot output to modem to more accurately simulate a real situation.
- Response from Group 1/3: Conferred with manufacturer who said equipment translates.
- Error rate even in highly trained PSAP call takers very high. Is it possible to reach consensus on error rate?
- Need to agree on some baseline to work from.
- Take Phased approach - get ballpark of examples of error rate 1% through 50% to try to establish consensus on acceptable error rate. Then ask questions of user and introducing increasing level of error to establish where limit of understanding is as related to error rate.
- Test must be able to be replicated. By making a recording of the test, the results are consistent over all systems and technologies.
- Tests in lab may not reflect field results. Human error adds dimension not considered by random, taped tests.
- User research determines the criterion. Group1/3 presented a way to determine error and the user determines if it's acceptable.
- Establish technical criteria, based on each company's evaluation of proper testing of equipment.
- Do both - use proposed test and then test by individual company criteria then bring tests back as information to group.
- Proposal to accept test.
- Artificial errors could exist in all calls.
- Proposed test is simple and no way to know what may affect test.
- Manufacturers need something valuable to test.
- Incorporate Toni Dunne's scenario-based text based on actual PSAP calls.

- Accept contribution as modified with scenario-based text.
- Discussion on error rate:
- Accept analog error rate at a PSAP to establish baseline.
- 9-1-1 trunks are engineered to a P.01 standard. The error rate will change based on caller, call taker and situation.
- 45.45 has always been sent via a voice path.

MODIFIED CONTRIBUTION ACCEPTED.

Discussion on Contribution TTY/98.02.11.06 (presented by Christopher Kingdon, Ericsson):

- Analog phones have an acceptable error rate - about 1% - 3%
- All domestic CDMA passes at 13kb - should work for TTY.
- Norman Williams provided test that showed that digital passed at an unacceptable rate. Need to do comparison of phones and digital technologies.
- Automated attendant at larger PSAPs to place call in queue is a problem to TTY.
- Question is when do you have a good electrical interface.
- Discussion on bit error rate vs. Character rate. Baudot is an analog protocol while bit error rate implies a digital protocol. Bit error rate implies error correction, character error rate relates to the test form.
- *Shift errors could impact the characters to next shift or end of the line. Error in transmission of shift could impact stream. Hitting the shift key will reset the next letters. PSAP operators are trained to hit space bar to correct garbled text.*
- 2.5 mm jack for hands free adapters gives easiest connection.

Vocoders used were the same; one just has more error correction.

Discussion on error rate:
Manufacturers cannot be held accountable for errors in the TTY protocol. Therefore, shift errors should only be counted as one air interface error. The additional errors are the problem of the TTY protocol. Manufacturers are responsible for providing acceptable interface for Internet, fax, modem, and have done so.
Error rates that are tolerable in other interfaces are small. The acceptable rates for the real world will be different from what engineers are accustomed to in fax, modems, etc.

Discussion on Contribution TTY/98.02.11.07(presented by Christopher Kingdon and David Fitzpatrick, Ericsson):
Ericsson included detail of lab report on PCS 1900 trials to answer questions from group regarding details of the Ericsson contribution at TTY-2.
In practice, a large percentage of phones are EFR and will be totally EFR in near future. The EFR vocoder performs at a lower error rate. Advancing technology has caused an improvement. It is not yet clear whether the error rate is acceptable but the errors are minimal. Big issue that remains is connection

between phone and TTY device. Ensure that there are a variety of price ranges available in the acceptable equipment. Some manufacturers of GSM equipment are prepared to negotiate with TTY manufacturers to provide interface. Vision includes an interface box to allow general compatibility. Will require some kind of conversion with a 2.5mm jack between phone and TTY device.
Aim for satisfying the requirements of FCC and then look to future to satisfy technology needed. TTY machines will have to be modified with jack and disable switch that activates acoustic coupler. Handset presented in TTY-2 will solve for embedded base. Shielding may be required to newer units. Manufacturers will need to focus on interface devices. Good market for entrepreneurs and forum does not want to impede any efforts in that area.

How do we determine a "reliable and compatible" TTY for effective PSAP communication?

- Benchmark text for manufacturers
- qualify error rate ("shift" error must be determined)
- true to life test script

Determine what can be done by Oct 1, 1998.

- acoustic coupler
- direct connect - but requires external battery, connection with phone and therefore adaptation for each manufacturer.

Use the handset as auto-jack, then pass audio to TTY.
If TTY just supplies dry audio - no intelligence, minimum requirement is two wires. Need Ultratec or TTY manufacturers to provide input/output specs and do they require voltage, ring, etc.
Manufacturers will meet with head of Ultratec to try to facilitate discussion under auspices of TIA. No standard to building the phone except four wire colors.

Question to group:
Is the TTY support issue solved if a WSP provides at least one digital phone model capable of TTY? By 10/1/98.
Comments:

- FCC must answer. But FCC will want to know if it's acceptable to consumer groups.
- Turn question around - Will all phones support TTY? NO. Some future phones may not be structured to allow interface of any kind due to small size or specific shape.

DAY 2
REPORT OF THE TTY CUSTOMER AWARENESS TEAM (T-CAT)

(Note: Notification Letter as modified and accepted by TTY-3 is attached as Appendix B)

Proposed Text in draft form was discussed. Intended to be simple and direct to assist users who are unfamiliar with wireless phones. Discussion of correct

adjectives to precisely define wireless phones as distinct from cordless or remote wireline handsets.

Discussion of availability of analog and digital adapters to identify whether any phones actually can send TTY today. Analog phones can provide TTY via several small handsets, and older models. Digital interface could be available shortly from Ericsson.

Distribution method is suggested by FCC but not mandated. Mandate is to provide notification.

Agreement to accept Notification Document as modified.

REPORT OF WORKING GROUP #2

Summary:
Proposal presented to direct Working Group #2 to focus their long term efforts on future technology such as Personal Assist Devices to allow the solutions to take advantage of technology innovations. Working Group #2 received approval to begin work on a User Requirements Document for this effort with the caveat that they produce a more detailed description of their direction for the next meeting. Working Group #2 requested more membership from the Deaf and Hard-of-Hearing group to assist in the development of the User Requirements Document.

Brye Bonner, Motorola, chair, and John Melcher, Harris County 9-1-1 presented report of Working Group #2.
Long Term effort is to evaluate digital wireless transport and establish benchmark expectations using lab tests.
Need to provide more services to those who need services most. Of the 28 million of hearing and speech impaired, how many are trying to place a 9-1-1 call over phones using a TTY device? Public Service proposal is to provide a Functional Equivalent.

Personal Digital Assist devices can now do both voice and digital 2-way text over wireless. Add one feature to provide an automated formatting interface to allow two way real time communications in Baudot. Interfaces are as cheap or expensive as required by a simple to elegant solution. Eliminate current system of relay that has human error and automate for communications relay without error. Can provide this system by October 1998? Not too optimistic. But can we get two way communications into the hands of the people who need it? A national distribution system could be put in place to put a PDA in the hands of all those who need it regardless of ability to pay. This is not modem pooling. It uses the wireless network, which is deploying faster and providing better nationwide coverage than the RAM modem system. There is an international effort ongoing to establish worldwide data standards. This group could submit requirements to be considered in the process. Recommend preparation of a SDO to submit

requirements to standards making organization to begin process of international standards development.

Request for consensus that this proposal represents the proper course of action for Working Group #2 in their search for a long-term solution.

Working Group #2 direction is approved to begin work on a User Requirements Document with requirement to produce a more detailed description of effort for the next meeting. Working Group #2 requests more membership from the Deaf and Hard-of-Hearing group to assist in the development of User Requirements Document.

FCC STATUS REPORT

Requirement to report to WEIAD to be included in their report to FCC and to follow reporting requirements of CC 97-402.

HOW TO IMPLEMENT SOLUTIONS/PROPOSALS

User Performance Test Development
Step 1 - Objective Test
Objective of test: provide manufacturers with a standard test that will provide a reliable measure of error rate in transmission over an air interface. Use Contribution TTY/98.02.11.10 - Real Life Test Pattern and add scenario-based modifications.
Accepted as modified.

Step 2 - Subjective Test - Chair of Working Group: Toni Dunne
Objective of test: What is acceptable error rate for end users with consideration that goal is for both parties understand each other.
Nature of test: Real time operation using a standard text. Shift error rate should possibly be calculated separately because of the impact on readability of text. User community can help determine impact after a shift error - it is averaged in the experience of users to be about 8 characters in a non-emergency situation. Compare to the missing of a shift to wireline errors and determine if the missed shift is attributable to the air interface.
Pass/Fail determine:

Acceptable error rate
-shift error rate calculated separately
-end user determines the acceptable rate
-landline shift error rate must be considered
-consider testing both end user parties
-recognize that PSAP call takers are trained to verify information (redundancy) to help reduce impact of shift errors
-find expert help in vocoder testing to assist in developing the test
-evaluators of test should include deaf and hard of hearing and PSAP call taker - consider testing both parties both called and caller

Name of Tests:
Throughput Accuracy Test (formerly Objective Test or Manufacturer Readability Test) to benchmark and calculate transport error rate.
Baudot Readability Test/End User Test (Subjective Test) Official name to be determined.
Test should replicate an end user in a real life situation (simulated in standard written text) and evaluate

NEW BUSINESS/NEXT STEPS

Questions for CONSENSUS:
Is the TTY support issue advanced if a WSP provides at least one digital phone model capable of TTY? By 10/1/98? Consumer groups say yes, if it includes all features that are available on other phones, is available at best cost, and has access to service on the digital network which seems to have better availability. FCC to address but will ask consumer groups. Question asked: will all phones support TTY? Answer: NO.

Is it acceptable in a dual mode (digital/analog) to have an interface turn off digital mode and enable analog mode only for TTY use if coupler is totally passive and requires no user intervention? Consumer group says not acceptable. Must focus on digital capabilities. CAN says that a digital solution that has features at the lowest price is acceptable. Consumers want to have equal access to what's available to the general public*.

*Clarification on comment by CAN received from Al Sonnenstrahl, CAN:

> I need to clarify my remark at the end of the previous meeting at Gallaudet University Kellogg Center last week.
>
> I made the comment that should there be one model, it should have all the features at the lowest price. I was referring to one model per manufacturer per technology... not one model per industry.

NEXT MEETINGS

April 1 and 2, 1998	**TTY Forum -4**	**Wash, DC**
May 20 and 21, 1998	**TTY Forum - 5**	**Wash, DC**

ISSUES FOR NEXT MEETING/ADJOURNMENT

1. Can TDMA/CDMA be sent over analog because of lack of confidence in dealing with the vocoder?
2. Remand statement draft re: "*TTY over digital, one phone per wireless service provider (WSP)*" to the steering committee to prepare as contribution to next meeting.

ATTENDANCE

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Ragsdale, Billy	Bell South, NENA	404-329-4146	404-325-2798	bragsdal@bellsouth.net
Ruby, Laura	AT&T Wireless Services	425-828-1354	425-828-8452	laura.ruby@attws.com
Samson, Ken	TDI	301-589-3006(tty)	301-589-3797	ksamsontdi@aol.com
Sonnenstrahl, Al	CAN	301-770-7555 (TTY)	same	sonny@clark.net
Spann, Charles	Nortel	972-231-0162	972-685-3478	charles_spann@nortel.com
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APPENDIX A

AGREEMENTS REACHED AT TTY FORUM - 1

- "Solve for 45.45 Baudot, not to preclude looking for other solutions."
- Look for long term and near term solutions.
  - Near term - send through vocoder
  - Long term - circumvent vocoder, enhance quality and connectivity
- Provide for the analog function of wireless phones.
- The only body that can change the agreements reached is this body. All agreements remain intact until/unless action is taken in this forum.

AGREEMENTS REACHED AT TTY FORUM - 2

- Combine Working Group #1 and Working Group #3. Develop new set of deliverables based on the October 1, 1998 deadline.
  - Short term solution: solve for backward compatibility.
  - Develop Standard Test to measure error rate of TTY over digital.

AGREEMENTS REACHED AT TTY FORUM - 3

- 6 sponsored spots for identified consumer groups, relinquished if member misses 2 consecutive meetings.
- Accept modified "readability test" to be used by phone manufacturers to benchmark TTY over digital capabilities, to determine success rate for transport. (See Contribution TTY/98.02.11.06) Two tests: Manufacturers Readability Test, End User Test
- Error rate is defined as "character" not "bit" for the purpose of this forum. (Shift error rate of ratio 1/8 (i.e. 1 shift error causes up to eight text errors and will be counted as such) to be determined)
- Develop User Requirements Document. The outcome of Working Group #2. Represents the effort to provide for future advancements in technology by looking at solutions beyond 45.45 baud, Baudot.
- Define process to update Notification Document: refer updated information to CTIA to be distributed to T-CAT.

APPENDIX B

Recommended Text

ATTENTION TTY USERS

Background

A TTY (also known as a TDD or Text Telephone) is a telecommunications device that allows people who are deaf, hard of hearing, or have speech or language disabilities to communicate by telephone. A TTY has a keyboard used to type a conversation, which then is transmitted as tones over a wired telephone line. The tones are translated to text that appears on a person's TTY screen.

911 and TTY Access Through Wireless Services

Federal law requires the telecommunications industry to provide a way for TTYs to communicate through **wireless systems** to make 911 calls. There are two types of wireless phones – analog and digital.

- Analog – It is possible today to use some analog wireless phones reliably to call 911 with a TTY.

- Digital – It is not possible today to use a digital wireless phone reliably to call 911 with a TTY.

Research is being done to improve the ability of digital phones to work reliably with TTYs. The industry is working to resolve this matter by October 1998.

[Optional: For more information, contact . . .]

DATE OF PUBLICATION:

Appendix G

UltraTec's Brochure, *Cellular TTY Calling*

CELLULAR TTY CALLING

You can use the EZ*com* Pro™ to make and answer cellular TTY calls. Using cellular technology allows you to be away from your home or office and keep your access to the telephone.

In order to use the EZ*com* Pro with cellular technology, you need the correct equipment:

- **RJ11 compatible intelligent interface (data converter)** allows you to use the cellular network for your TTY conversations.
- **Cellular telephone (analog)** with an external connector that is compatible with the intelligent interface cable. The external connector allows you to plug the RJ11 intelligent interface cable into your cellular telephone.

Where can you get this equipment?

You can find the equipment that you need at your cellular telephone provider. They have the equipment you need or they can order it for you. Prices will vary depending on the type of cellular telephone you select.

Bring the EZ*com* Pro and this guide to your cellular provider when you want to start using the cellular network. The guide will help your cellular provider find the correct equipment. See *For the cellular telephone provider* on the back page for more information.

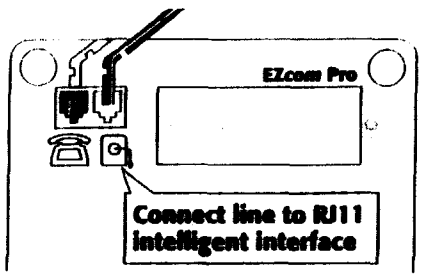
Also, this guide will help you make practice calls to ensure that the equipment works properly before you buy it.

Setting up the EZ*com* Pro with a cellular telephone

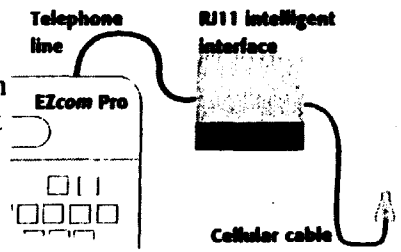
Before you set up, make sure that the EZ*com* Pro, the RJ11 intelligent interface, and the cellular telephone have batteries installed. Check each device's instruction manual for more information.

The following procedure describes the basic set up with most brands of cellular equipment.

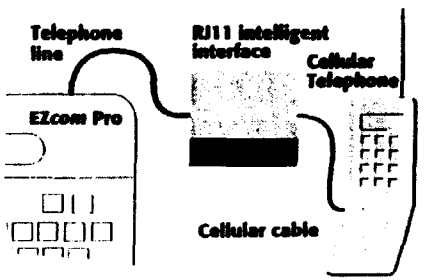
1. Plug one end of a telephone line into one of the jacks on the bottom of the EZ*com* Pro.



2. Plug the other end of the telephone line into the jack on the RJ11 intelligent interface.



3. Plug the cellular cable into the cellular telephone's external connector.



Note: The equipment depends on your cellular telephone type. This setup may look slightly different from the setup you will use.

Making a cellular TTY call

Because cellular technology uses frequencies (like radio waves) to transmit information, make sure that you are in your cellular calling region and in a location that allows for good transmission and reception. Contact your cellular provider for more information.

To make a TTY call, do the following:

1. Turn on the RJ11 intelligent interface.
2. Turn on the cellular telephone.

   Make sure that your cellular telephone has established a signal for calling. See your cellular telephone's instruction manual for more information.
3. Press the [Dial] key on the EZ*com* Pro.
4. Dial the telephone number using the number keys on the EZ*com* Pro keyboard.
5. Wait for a greeting message.
6. When you see a greeting, begin your conversation.
7. When your conversation is finished, turn off the EZ*com* Pro, the RJ11 intelligent interface, and the cellular telephone.

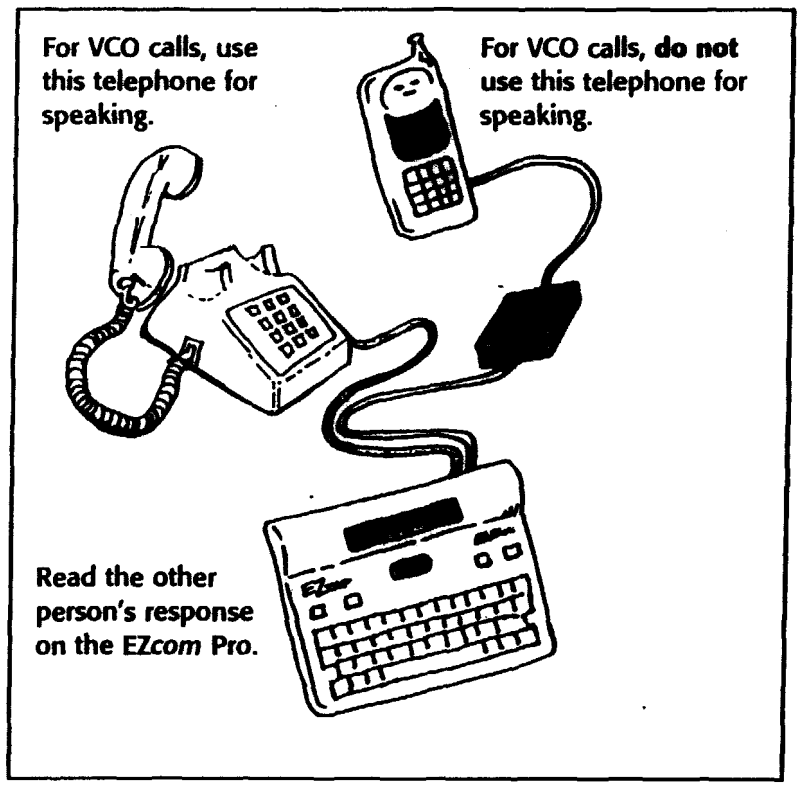
Note: The procedure that you use to make a call may vary depending on your cellular telephone.

Voice Carry Over (VCO) users

Due to limitations of cellular technology, the cellular telephone cannot be used for both voice and text at the same time. In order to use VCO, you need to connect a separate standard telephone to the second jack on the bottom of the EZ*com* Pro. Use this telephone when you want to speak to the other person.

If you try to talk to the other person using the cellular telephone after you have begun a text conversation, the other person will not hear you speaking.

Below is an example of the cellular set up used for making VCO calls. This example is for illustrative purposes only. Depending on your cellular telephone type, the set up you use may be slightly different. In addition, you may choose a more compact portable telephone.



Answering a cellular TTY call

Cellular telephones must be turned on before they are able to receive a call. For options on knowing when you are receiving a call, contact your cellular telephone provider. These options may vary depending on the cellular telephone that you own.

1. The cellular telephone "rings," signaling that you have an incoming call.
2. Turn on the RJ11 intelligent interface.
3. Answer the call as explained in your cellular telephone's instruction manual.
4. Turn on the EZ*com* Pro and type a greeting.
5. Continue with your conversation.
6. When your conversation is finished, turn off the EZ*com* Pro, the RJ11 intelligent interface, and the cellular telephone.

Note: The procedure that you use to answer a call may vary depending on your cellular telephone.

Troubleshooting tips

The cellular telephone network is very different than the traditional telephone system. The availability, the costs, and the quality of connections associated with cellular telephones vary from state to state. Even non-TTY callers occasionally have problems with cellular calling.

If you are having trouble connecting or you are disconnected during your conversation, check the following items:

- *I'm having difficulty connecting my call.*

  Make sure your cellular telephone is an analog type.

  Are the EZ*com* Pro, RJ11 intelligent interface, and cellular telephone all turned on?

  Does each device have power (batteries installed)?

- *My cellular telephone seems to be dialing the telephone number, but I'm not connecting.*

  Are you in your cellular calling region?

  Did the cellular telephone establish a signal before you dialed the telephone number?

- *After my conversation has begun, I am disconnected with the other person and receive garbled text.*

  Are you making a call while moving? For example, are you riding a train, car, bus, etc? If so, you may be losing your cellular connection due to tunnels, hills, or valleys. Try calling the other person again from a location where these items will not interfere with your cellular call.

Contact your cellular provider for more information about these or any other calling difficulties that you may experience.

For the cellular telephone provider

- The EZ*com* Pro TTY works like a standard analog telephone, and requires a "dial tone" in order to work with a cellular telephone.
- The cellular telephone must be analog not digital.
- An RJ11 compatible intelligent interface is required in order for the EZ*com* Pro to send its data (text conversations), along with an appropriate cable to connect the interface to the cellular telephone. The RJ11 intelligent interface is sometimes referred to as a modem, data link, data connector, or a data box.
- The EZ*com* Pro does not use the PCM or PC modem cards that many laptop computers use.
- While the specific RJ11 intelligent interface will depend on the make and brand of the cellular telephone, the following RJ11 intelligent interfaces have been tested with the EZ*com* Pro for making and answering TTY calls:

RJ11 Compatible cellular interfaces

Motorola Cellular Connection™

Part #	Cellular telephone type
S1936	Motorola car-mounted and bag-style
S3027	Motorola portable–flip style (Model S3027 may work with other cellular telephone brands if the proper data cable is used.
S4229	Motorola portable–Elite flip style

Axcell® Intelligent Interface

Part#	Cellular telephone type
1A02X001	Audiovox 3 watt series V
1A02X002	Motorola Micro TAC series
1A02X003	Motorola 3 watt (series 2, 3, and 4)
1A02X004	Ericsson/GE micro-portable CT700
1A02X005	NEC P700/800 series
1A02X006	Motorola Elite series

Note to providers: If you do not carry these parts or if the customer is using a cellular telephone brand that is not compatible with the equipment listed above, please recommend equivalent equipment that provides the same capability.